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PROCEEDINGS

OF THE

ROYAL SOCIETY OF EDINBURGH.

1833-34.

No. 3.

December 2.

SIR THOMAS MAKDOUGALL BRISBANE, K. C. B.
President, in the Chair.

The following Donations were presented :—

Flora Batava. Nos. 93 and 94.—*From the King of Holland.*

The Fortunate Union, a Romance. Translated from the Chinese original, with Notes and Illustrations, by John Francis Davis, F. R. S. 2 vols.

Hoeï-Lan-Ki, ou l'Histoire du Cercle de Craie, Drame en Prose et en Vers, traduit du Chinois, et accompagné de Notes. Par Stanislas Julien.

San Kokf Tsou Ran To Sets, ou Aperçu Général des Trois Royaumes. Traduit de l'original Japonais-Chinois, by Mr. J. Klaproth.

The Shah Nameh of the Persian Poet Firdausi. Translated and Abridged, in Prose and Verse, with Notes and Illustrations, by James Atkinson, Esq.

History of the Pirates who infested the China Sea from 1807 to 1810. Translated from the Chinese Original, with Notes and Illustrations, by Charles Fried. Neumann.

The Life of Hafiz Ool-Moolk, Hafiz Rehmüt Khan, written by his son. Abridged and translated from the Persian, by Charles Elliot, Esq.

The Geographical Works of Sádik Isfáhani. Translated by J. C. from original Persian MSS. in the collection of Sir William Ouseley, the Editor.

The Algebra of Mahommed Ben Musa. Edited and Translated by Frederic Rosen.

- The Life of Sheikh Mahommed Ali Hazin, written by himself. Translated from two Persian Manuscripts, and illustrated with Notes, by F. C. Belfour, M. A., Oxon, F. R. A. S., LL. D.
- History of the War in Bosnia, during the years 1737-38-39. Translated from the Turkish by C. Fraser, Professor of German in the Naval and Military Academy, Edinburgh.
- Customs and Manners of the Women of Persia, and their Domestic Superstitions. Translated from the original Persian Manuscript, by James Atkinson, Esq.
- Miscellaneous Translations from Oriental Languages. Vol. 1. Yakkun Nattannawā; and Kōlan Nattannawā. Cingalese Poems. Translated by John Callaway.
- Memoirs of a Malayan Family, written by themselves, and translated from the original by W. Marsden, F. R. S., &c. &c.
- The Siyar-ul-Mutakherin; A History of the Mahomedan Power in India during the last century. By Mir Gholam Hussein-Khan. Revised from the translation of Haji Mustefa, and collated with the Persian original by John Briggs, M. R. A. S. Lieutenant-Col. in the Madras Army.
- History of the early Kings of Persia. Translated from the original Persian of Mirkhond, by David Shea.
- The History of the Maritime Wars of the Turks. Translated from the Turkish of Haji Khalifeh, by James Mitchell. Chapters 1 to 4.
- The History of Vartan, and of the battle of the Armenians; containing an account of the Religious Wars between the Persians and the Armenians. By Elisæus, Bishop of the Amadunians. Translated from the Armenian by C. F. Neumann.
- The Mulfuzât Timûry, or Auto-Biographical Memoirs of the Moghul Emperor Timûr. Translated from the Persian by Major Charles Stewart.
- The Adventures of Hatim Tai; a Romance. Translated from the Persian by Duncan Forbes, A. M.
- History of the Afghans. Translated from the Persian of Neamet Ullah by Bernard Dorn. Part 1.
- Hân Koong Tsew, or the Sorrows of Hân: a Chinese Tragedy. Translated from the original, with notes, by John Francis Davis, F. R. S.
- The Travels of Macarius, Patriarch of Antioch; written by his attendant Archdeacon Paul of Aleppo, in Arabic. Translated by F. C. Belfour, A. M. Oxon. Parts 1, 2, and 3.
- Memoirs of the Emperor Jahangueir, written by himself; and translated from a Persian Manuscript by Major David Price.

- Raghuvansa Kalidasæ, Carmen Sanskrité et Latiné edidit Adolphus Fredericus Stenzler.
- Private Memoirs of the Moghul Emperor Humāyūn. Written in the Persian language by Jonher, a confidential domestic of his Majesty. Translated by Major Charles Stewart, M. R. A. S., &c.
- Annals of the Turkish Empire, from 1591 to 1659 of the Christian era, by Naiman. Translated from the Turkish by Charles Fraser. Vol. 1.—*From the Oriental Translation Fund.*
- Sexagesimal Logarithms.—*From Fletcher Raincock, Esq.*
- Astronomische Nachrichten. Nos. 39 and 40.—*From Professor Schumacher.*
- Alphabetical Index of the Transactions of the Royal Society of London, from vol. cxi. to vol. cxx. inclusive.—*From the Royal Society.*
- Abhandlungen der Königlischen Akademie der Wissenschaften zu Berlin, aus den Jahre 1830 and 1831. 2 vols.—*From the Academy.*
- Reports of the Commissioners appointed to fix the boundaries of the English burghs under the Reform Bill. 10 vols.
- Reports of the Commissioners appointed to fix the boundaries of the Irish burghs under the Reform Bill. 1 vol.—*From — Drummond, Esq.*
- Transactions of the Cambridge Philosophical Society. Vol. v. part 1.—*From the Society.*
- Recueil de Voyages et de Mémoires publié par la Société de Géographie de Paris. 3 tomes.—*From the Society.*
- The Internal Structure of Fossil Vegetables, found in the Carboniferous and Oolitic Deposits of Great Britain, described and illustrated. By Henry T. M. Witham of Lartington, F. G. S., F. R. S. E.
- The Quarterly Journal of Agriculture; and the Prize Essays and Transactions of the Highland Society of Scotland. No. 21.—*From the Highland Society.*
- Mémoire Explicatif des Phénomènes de l'Aiguille Aimantée. Par Demonville.
- Sur la possibilité de mesurer l'Influence des Causes qui modifient les Elémens Sociaux. Par A. Quetelet.—*From the Author.*
- Bulletin de l'Académie Royale des Sciences et Belles-Lettres de Bruxelles, 1832–33. Nos. 1–12.—*From the Society.*
- Recherches sur les Poids de l'homme aux differens Ages. Par A. Quetelet.—*From the Author.*
- Philosophical Transactions of the Royal Society of London, 1833. Part 1.—*From the Society.*
- Address to the third General Meeting of the British Association for

- the advancement of Science. By the Rev. W. Whewell.—*From Professor Forbes.*
- A Letter to the Members of the Temperance Society. By James Henry, M. B.
- Miliaria accuratius descripta, a Jacobo Henry, M. D.—*From the Author.*
- Catalogue of Preparations, &c. in Morbid, Natural, and Comparative Anatomy, contained in the Museum of the Army Medical Department, Fort Pitt, Chatham.—*From Sir James M'Gri-gor, Bart.*
- Bulletin de la Société Géologique de France. Tome iii. Feuilles 6-9 and 14-16.—*From the Society.*
- Barometrical Tables for the use of Engineers, Geologists, and Scientific Travellers. By William Galbraith, M. A. — *From the Author.*
- Transactions of the Literary and Historical Society of Quebec. Vol. iii. parts 1 and 2.—*From the Society.*
- Transactions of the Royal Irish Academy. Vol. xv.—*From the Academy.*
- Asiatic Researches, or Transactions of the Society instituted in Bengal, for inquiring into the History, the Antiquities, the Arts and Sciences, and Literature of Asia. Vol. xvii.—*From the Society.*
- The American Journal of Science and Arts. Conducted by Benjamin Silliman, M. D., LL. D., Professor of Chemistry and Mineralogy, &c. in Yale College. Vols. xx.-xxiv.—*From the Editor.*
- Transactions of the Zoological Society of London. Vol. i. part 1.
- Proceedings of the Committee of Science and Correspondence of the Zoological Society of London. Parts 1 and 2.—*From the Society.*
- Tabelle über die Geologie, von Hermann von Meyer.—*From the Author.*
- Lettre à la Nation Anglaise, sur l'union des Peuples et la Civilization comparée ; sur l'Instrument économique du Temps, appelé Biometre, ou Montre Morale. Par Marc-Antoine Jullien de Paris.—*From the Author.*
- Proceedings of the Geological Society of London, 1833. Nos. 31-32.
- List of the Members of the Geological Society of London, 1833.—*From the Society.*
- Memorie della Reale Accademia delle Scienze di Torino. Tome xxxvi.—*From the Academy.*
- Transactions of the Royal Asiatic Society of Great Britain and Ireland. Vol. i. parts 1 and 2, vol. iii. parts 1 and 2.—*From the Society.*

Conjectures relative to the origin of Numeral Hieroglyphics. By T. S. Davies.—*From the Author.*

Bulletin de la Société d'Encouragement par l'Industrie Nationale, pour les Années 1824-33. Jan. Fevr. Mars, Avril, Mai, Juin.
—*From the Society.*

Astronomical Observations made at the Royal Observatory at Greenwich. By the Rev. Dr N. Maskelyne. Vols. 2, 3, and 4.

Astronomical Observations made at the Royal Observatory at Greenwich, from 1811 to 1832, 44 parts. By John Pond, Esq.

Mémoires de l'Académie Impériale des Sciences de St Petersburg, Vime Série (Sciences Mathématiques, Physiques, et Naturelles). Tomes i. and ii. Livres 1, 2, 3, 4.

Mémoires de l'Académie Impériale des Sciences de St Petersburg, Vime série. (Sciences Politiques, Histoire, et Philologie.) Tomes i. and ii.

Mémoires de l'Académie Impériale des Sciences de St Petersburg. Présentés par divers Savans, et lus dans ses Assemblées. Tome i. Livr. 1-6.

Recueil des Actes de la Séance publique de l'Académie Impériale des Sciences de St Petersburg, 1828-32. 5 parts.—*From the Imperial Academy.*

Verzeichniss der Pflanzen. Vom Dr C. Anton Meyer.—*From the Author.*

Catalogue Raisonné des Objets de Zoologie recueillis dans un Voyage au Caucase. Par E. Ménétries.—*From the Author.*

Hyperanthrax, or the Cholera of Sunderland. By W. Reid Clanny, M. D., F. R. S E., M. R. I. A.—*From the Author.*

The following Communications were then read :—

1. On a New Species of Coloured Fringes developed between certain pieces of plate-glass, exhibiting a new variety of polarization, and a peculiar property which renders them available for the purposes of Micrometry. By Mungo Ponton, Esq.

The author, when he first observed these fringes, found that they presented the appearance of three rectilinear bands, each consisting of black, white, and coloured stripes ; but the central band was afterwards found to be composed of two united into one. There is thus a band for each of the four surfaces of the plates, the two side ones, appertaining to the uppermost and undermost surfaces, and the centre ones to the surfaces which are approximated. The peculiarities by which they are distinguished are as follows :—

1st, They are confined to certain specimens of glass, but not to perfectly parallel plates.

2d, They are exhibited while the plates are at a considerable distance from each other, provided their surfaces are preserved as nearly parallel as possible ; and they are not affected even by the interposition of another plate between those by which they are formed.

3d, They are destroyed by the application of Canada balsam or oil of turpentine to any one of the four surfaces.

4th, They are of uniform breadth and appearance, so long as the disposition of the plates remains the same, and are not affected by pressure in whatever manner it may be applied. The Newtonian fringes, on the other hand, are affected, both in breadth and direction, by the manner in which the plates are pressed together, so that they can be produced at right angles, or in any other position, with respect to the new bands.

5th, The fringes under consideration are produced by the light which is returned inwards upon the plates by reflection from their anterior surfaces, so that the rays suffer three reflections and four refractions before reaching the eye.

6th, They present phases of revolution which follow a different order according to the surfaces that are placed together, and varying, as the revolution is made, from right to left or from left to right. The bands revolve only at half the rate at which the plates move during the first semi-revolution ; and during the last quarter of revolution, when certain faces are together, there is a complete breaking up of the rectilinear fringes, which spread themselves in curvilinear forms over the whole surface of the plates.

7th, When viewed by homogeneous light, the fringes appear as light and dark stripes, covering the entire surface of the plates, and of uniform breadth which cannot be altered, except by changing the arrangement of the plates ; but by turning one of these, both the breadth and direction of the stripes are changed. Their number varies from 10 or 12 to nearly 2000.

8th, The plates which exhibit the fringes do not display any symptoms of possessing the doubly refracting structure, when viewed by polarized light. The appearance of the bands, however, is the same as that of the fringes, produced by crossing wedge-shaped plates of sulphate of lime, and passing polarized light through them, as described by Dr Brewster. It is therefore probable, that the new fringes are occasioned by the intersection of oppositely polarized pencils of light, whose polarity is induced by the repeated reflections and refractions which they undergo in passing and repassing through the plates—and it would seem as if each surface exerted an inde-

pendent and peculiar polarizing effect on the rays,—a hypothesis which appears necessary to account for the phenomena attending a change in the disposition of the surfaces.

9th, They possess a peculiar property, which the author conceives will render them available for the purposes of micrometry. When the surfaces of the plates are parallel, two of the bands are united into one at the centre ; but if a film be introduced between the plates, so as to cause them slightly to diverge, the two bands in the centre will be separated, and move laterally from each other, still preserving their perfect parallelism. A film, $\frac{1}{3000}$ th of an inch in thickness, causes the central bands to separate to a distance of an inch, so that every $\frac{1}{20}$ th of an inch of separation is equivalent to $\frac{1}{15000}$ th of an inch of thickness. When smaller thicknesses are to be measured, recourse must be had to the side bands, which are affected by a much slighter degree of divergence than the centre ones. A thickness so minute as that of gold leaf may be rendered sensible by the side bands, and a scale for micrometry might be found, by introducing successive leaves of gold of a known thickness.

2. Communication relative to the Fresh-Water Limestone of Burdiehouse, near Edinburgh, belonging to the Carboniferous Group of Rocks. By Dr Hibbert.

In his paper, the author explains that the limestone in question, which is confounded with the common carboniferous or mountain limestone of marine origin, is, in his opinion, of fresh-water origin.

On an irregular line extending from Joppa on the coast of the Firth of Forth, in a south and south-west direction to the Pentland Hills, strata of mountain or carboniferous limestone crop out at intervals ; and their marine origin is indicated by encrinites, the *Productus*, &c., and corallines. This limestone is developed with least interruption between Edmonstone and Muirhouse, where it is from twelve to twenty feet thick. At this part of the line may be seen fractures and elevations of the strata of limestone and superincumbent shale and sandstone, evidently occasioned by a sudden and violent uplifting force acting from north-east to south-west, and causing the uplifted strata to dip south-east at an angle of 25° . These uplifted beds, between Edmonstone and Muirhouse, and subsequently to Burdiehouse, form the strata which dip under the coal-measures of Gilmerton, Loanhead, and other sites.

At Muirhouse Quarry the same mountain limestone is seen, but a covered state of the ground succeeds in the same south-west direction for a mile, in which no outcropping strata are observable, except some beds of sandstone about the middle of that space, dipping with the

other strata towards the south-east at an angle of 25° , and situated higher than the limestone.

At the south-west termination of this space is situated the Quarry of Burdiehouse. It is difficult to determine, from the covered state of the ground, whether the bed of limestone here seen is lower or higher than the mountain limestone hitherto described; possibly the mountain limestone may here thin off, and be replaced by the Burdiehouse bed. The appearance of the strata, however, which crop out between Burdiehouse and Loanhead, dipping near the former site towards the south-east at an angle of 30° , and towards the latter at a less angle in the same direction, shew that the limestone of Burdiehouse, in common with the mountain limestone cropping out between Edmonstone and Muirhouse, is lower, and therefore of older formation, than the coal-measures of Gilmerton and Loanhead. Hence the limestone of Burdiehouse and the mountain limestone of marine origin, are jointly referable to one common epoch of formation.

The Burdiehouse limestone, however, is clearly not of marine, but of fresh-water origin. It forms a bed of twenty-seven feet in thickness, composed of strata about four and a-half feet thick, dipping south-east at angles of 23° and 25° , with the seams of stratification regular and continuous, and also with intersecting vertical seams. The bed is surmounted by bituminous shale, with which very thin layers of limestone occasionally alternate. The colour of the limestone is grey, brown, and occasionally purple; its fracture conchoidal, but often slaty, from the intervention of thin striæ of vegetable or bituminous matter; its texture hard and compact; its aspect dull, and it is not crystalline like the limestone of neighbouring quarries. It is tolerably pure, shewing little foreign matter except what is bituminous; and this is often disposed between the layers of the limestone where its structure is slaty. But its most remarkable character is the nature of the organic remains contained in it. These are, in the first place, plants belonging to the oldest vegetation of the globe; among which the *Sphenopteris affinis*, *Sphenopteris bifida*, *Lepidostrobus variabilis* of Mr Lindley, and various kinds of the *Lepidodendron*, seem to be ascertained. The species are numerous and distinct, so as to afford the most beautiful specimens that can be conceived, and a rich store of observation in fossil botany. But, secondly, the animal remains are even more interesting. One fragment of a fish, which, when entire, must have measured a foot in length, is closely allied to the fresh-water species of the family of *Cyprinidæ*. Innumerable minute animals referable to the fresh-water *Entomostraca* are also to be seen; one of these is probably a *Cypris*, and indications have been found of minute *Conchifera*, and of coprolites in great abundance.

The inference appears to the author irresistible, that the Burdiehouse limestone is of fresh-water origin. The neighbouring mountain limestone abounds in corallines, encrinites, and shells, all evidently marine. These are in vain sought for in the limestone of Burdiehouse; which, on the other hand, presents the remains of Fishes apparently inhabiting fresh-water, and of Ferns, Lycopodiaceous plants, and such aquatic vegetables as flourish most among fresh-water lakes and marshes. This limestone, then, is the memorial of some inland fresh-water lake or tank, within the waters of which it was elaborated.

December 16.

SIR HENRY JARDINE in the Chair.

The following Donation was presented :—

Transactions of the Agricultural and Horticultural Society of India.
Vol. ii. parts 1. and 2.—*From the Society.*

The following communications were read :—

1. "A General View of the Phenomena displayed in the Neighbourhood of Edinburgh by the Igneous Rocks in their relations with the Secondary Strata; with reference to a more particular description of the section which has been lately exposed to view on the south side of the Castle Hill." By the Right Hon. Lord Greenock.

The author referring, in the introductory part of his paper, to the views taken by Hutton of the structure of the earth's surface around Edinburgh, explained,—That the prevailing rocks are strata of sandstone and shale of the coal formation, with occasional beds of limestone; and interrupted by insulated as well as grouped hills of igneous origin, rising abruptly through them,—That the latter or trap-rocks, seem in many quarters interstratified with the former, as if they had burst while in a state of fusion between the strata of the secondary rocks,—That fragments of the secondary rocks are often seen imbedded in the trap, as if they had been broken away from the strata to which they belonged, and been hurried along by the fused erupted mass,—And that the trap-rocks often present very different appearances in the same hills, shewing that they were erupted under varying circumstances at different periods of time. The author farther explained, that the environs of Edinburgh seem to constitute a great basin, surrounded by trap-rocks, which dip outwards in all di-

rections from a common centre,—the Pentland Hills, forming the southern boundary, the rocky coast of Fife at Burntisland the northern, and Salisbury Craigs and Corstorphine Hill the eastern and western limits.

The paper then proceeds to describe the appearances presented by a late section of the southern face of the Castle Hill, where several of the phenomena referred to above are very well illustrated. The great mass of the Castle Hill rock is a dark compact greenstone. Towards the south-west point, altered rocks are seen resting on the trap in a highly inclined position; and within the Castle wall, fragments of sandstone are imbedded in the greenstone, shewing that the latter must have burst in a state of fusion through the strata of the former. But at the south-east point of the rock, beyond the walls, the section lately made in cutting the new south-west road has displayed appearances, which, in the author's opinion, supply strong evidence that, subsequent to such eruption, the secondary and trap-rocks had been uplifted together by a common cause, probably acting on a great extent of the face of the country. This section shews five or six beds of sandstone, with alternate layers of slate-clay or marl. Signs of great confusion are found in these strata, more especially as they approach the point of junction with the trap-rock,—their eastern extremity being thrown upwards, while their western portion is cast down, so as to lie unconformably on the upturned strata; and near the point of junction with the greenstone, the ends of the strata of sandstone and slate-clay are shattered, and have actually fallen over, so as to come obliquely in contact with the tabular masses of the greenstone. Yet it is remarkable, that the sandstone and shale present no appearance of semi-fusion or intermixture, where they are in contact with the greenstone; nor does the greenstone here present any imbedded masses of the secondary rocks, nor send out any veins among their adjacent strata. At the time, therefore, when the dislocation of the sandstone strata occurred at the point of junction with the greenstone, the latter could not have been in a state of fusion; and the only rational explanation which occurs is, that both rocks were raised, *in a solid state*, by some common cause, above the level of the waters under which they were originally formed; and that the fault or dislocation in the sandstone strata was produced by some subsidiary disturbing power acting at the same period.

2. Researches on the Vibrations of Pendulums in Fluid Mediums. By George Green, Esq. Communicated by Sir G. Ffrench Bromhead, Bart.

The author proposes in this paper to resolve a particular case of

the motion of fluids, not previously noticed, and susceptible of practical application, namely, the circumstances of the motion of an indefinitely extended non-elastic fluid, where agitated by a solid ellipsoidal body moving parallel to itself, according to any given law ; always supposing the body's excursions very small compared with its dimensions. The question here stated is considered by the author to admit of an easy general solution. As the principal object of his paper is to determine the alteration produced in the motion of a pendulum by the action of the surrounding medium, he insists more particularly on the case where the ellipsoid moves in a right line parallel to one of its axis ; and endeavours to prove that, in order to obtain the correct time of a pendulum's vibration, it will not be sufficient merely to allow for the loss of weight caused by the fluid medium, but that it will likewise be requisite to conceive the density of the body augmented by a quantity proportional to the density of this fluid. He determines the value of the quantity last mentioned, when the body of the pendulum is an oblate spheroid, vibrating in its equatorial plane ; and finds, that when the spheroid becomes a sphere, the quantity is precisely equal to half the density of the surrounding medium. Hence in the last case, the true time of the pendulum's vibration is obtained, if it be supposed to move in vacuo, and its mass be simply conceived to be augmented by half that of an equal volume of the fluid, while the moving force with which it is actuated is diminished by the whole weight of the same volume of fluid.

8. Observations on the Fossil Fishes lately found in Orkney. By Dr Traill.

The geologist has been for some time acquainted with the occurrence of Fossil Fishes in Caithness, and they have been more lately found also in Orkney, especially near Skaill, the seat of W. G. Watt, Esq. in Pomona.

The author describes these fishes as imbedded in a dark coloured flag, which lies beneath three feet of soil and loose stone, and eleven feet of solid beds of similar flag, but destitute of organic remains. The fishes are contained in two strata, measuring together about two feet in thickness. The upper stratum contains only fishes belonging to the *Cartilaginei*, and seemingly the genus *Raia* ; the lower contains numerous fishes that belong to the orders Thoracici and Abdominales, most of them with distinct scales. Almost all of them lie on their bellies or sides, none on their backs, and their attitudes generally bespeak the energy of their final struggles. The fishes of these two contiguous strata are never intermixed. The strata dip

about one foot in seven to the north-west. The author found only a single specimen of a petrified vegetable with the fishes. It was the leaf of a canna or a reed.

The Orkney Islands have much uniformity in their geological structure. The principal rock is this sort of slate, which is connected with sandstone, and has occasionally interposed thin beds of limestone, that seldom contain any organic remains.

The only primitive rocks in Orkney are in a limited district around Stromness, and in the contiguous small island of Græmsey. There granite, and gneiss approaching to mica-slate, appear in the surface, and have resting on them a coarse sandstone conglomerate. This last is in immediate contact with the slaty rock described above. The highest ridges in Orkney are the mountains of Hoy, which are composed of thick beds of sandstone, in which the author lately discovered a vast bed of trap. This sandstone, as well as that which occurs in the other islands, belongs to the old sandstone; and the slaty rock is probably a newer part of the same formation.

There are not any distinct traces either of the mountain limestone or of the coal formation in Orkney, unless we are disposed to consider this slaty rock as the oldest member of the mountain limestone. But from its connexion with the sandstone, it is safer to reckon it a member of the old red sandstone series.

Specimens were exhibited to the Society illustrative of the author's statements.

4. Notice of further Discoveries at Burdiehouse. By Dr Hibbert.

The author announced that, since his former paper was read, on the organic remains of the limestone quarry at Burdiehouse, discoveries of still greater interest had been made. These chiefly consist of the remains probably of a large animal of the Saurian tribe, namely, what appears to be the epiphysis of one of the vertebræ, presenting, when broken across, the cancellated structure of bone—several large scales obtained by Mr Connell,—and, in particular, a large and beautifully perfect tooth, two inches and a quarter long, and covered with its enamel, which is quite entire. The remains here alluded to were exhibited and presented by the author and Mr Connell to the Society's Museum.

January 6. 1834.

SIR T. M. BRISBANE, President, in the Chair.

The following Communications were read :—

1. On the Investigation of Magnetic Intensity, by the Oscillations of a Horizontal Needle. By William Snow Harris, F. R. S.

The chief disturbing causes by which the magnetic intensity, as ascertained by the oscillations of the horizontal needle, are affected, are 1. Variations in the air in which they are performed ; 2. The influence of changes in the mechanical conditions incidental to the mode of suspending the needle ; 3. Changes in the disposition and intensity of the magnetism of the needle from heat and other causes.

These causes of disturbance the author proceeded to investigate.

I. He compared the oscillations of the needle vibrating in air, with those of the same needle oscillating *in vacuo* ; and he minutely described the apparatus which he had contrived for allowing the needle to vibrate freely in an exhausted receiver, and his mode of determining the arcs of vibration. This apparatus enabled him to appreciate the resistance of air to the oscillations of the needle, and its effect in rendering *unequal* the duration of vibrations performed in long and in short arcs. Hence he inferred the impossibility of ascertaining the alleged diurnal changes of magnetic intensity by the common apparatus.

II. The second source of disturbance he endeavoured to obviate by a more accurate mode of suspending the needle ; by which its centre of gravity and point of magnetic neutrality should be made to coincide. This the author proposes to accomplish by greater care in finding its true centre, and in adjusting its horizontality by means of small sliding counterpoises of platinum on each arm.

III. The influence of increase of temperature on the magnetic needle has generally been considered as *lowering* the tension of its magnetism ; and it has been represented as again restored by cold : but the author's experiments seemed to prove the contrary, when the comparative experiments were made *in vacuo*. He considers, however, that if the needle be prepared, by being previously exposed to a variation of temperature from 212° to 0° of Fahrenheit, its tension will not afterwards be affected by ranges of temperature within these limits.

One of the most interesting parts of Mr Harris's paper is his mode of determining changes of magnetic tension in a particular magnet

It is well known that if a needle be made to vibrate within a ring of copper, it will be more speedily brought to rest, than if vibrating in open space. The influence of the ring of copper, therefore, might be employed to detect changes in tension, provided the force which induced motion in the needle, and that force by which it would eventually be reduced to rest *without* the ring, were both constant quantities. This, however, is not the case; but the author proposes to reverse the experiment, and cause the *ring to vibrate round the needle*, placed within it, so as just not to touch the ring. This will afford a comparative measure of the force of the needle at its poles, if we observe the influence of the needle in reducing the ring to a state of rest. A convenient mode of doing this he has given, and has deduced a general formula for estimating the differences in magnetic tension thus detected.

The author has also examined the influence of bright sunshine on the suspended needles; and has shewn that the difference observed in the oscillations of the needle in sunshine and in the shade, may be made nearly to vanish in the exhausted receiver; and he has rendered it probable, that the slight differences observed in bars oscillating in the sun's rays, are not altogether dependent on magnetism.

Lastly, the author endeavoured, by an artificial electric *aurora* in a *luminous conductor*, six feet long and four inches wide, to ascertain whether there was any effect produced on a finely suspended needle, placed within eighteen inches of the conductor; but the oscillations of the needle were not affected by a stream of electricity procured for twenty minutes from a powerful machine in this apparatus,

2. Experiments on Magnetic Intensity made at Liverpool and Manchester. By Dr Traill.

Dr Traill made a report to the Society of experiments made by him in 1832 at Liverpool and Manchester on magnetic intensity, measured by the oscillations of the horizontal needles belonging to the Society, which had been sent to him for that purpose. The reporter also stated the result of a series of experiments made by Professor Oersted and himself in Liverpool in 1823, which is important, as having been made use of by Professor Hansteen in constructing his *isodynamic magnetic lines* for Great Britain.

The result of Dr Traill's experiments is, that Hansteen has estimated the magnetic intensity of England a little too high, as Mr Dunlop found he had that of Scotland; and the reporter concluded that this

arose from the experiments on which Hansteen founded his calculation being affected by some degree of local attraction, from the confined spaces in which the experiments were made.

The magnetic intensity, as deduced from the time of 300 vibrations in the reporter's experiments with the Society's needles, is, with Hansteen's cylindrical needle,

At Liverpool, mean of three series = $798''.21$

At Manchester, from one series . = 798.82

With Dollond's flat needle

At Liverpool, mean of three series = 1052.83

At Manchester, from one series . = 1051.76

The reporter also stated, that the magnetic dip at Liverpool, as ascertained by several experiments made there by Lieutenant Allen, R. N. and himself, with a needle furnished by the Board of Admiralty, for the late expedition up the Niger, is = $72^{\circ} 2' 24''$.

The experiments on the dip, as well as two other series on magnetic intensity with a horizontal needle belonging also to the Admiralty, were made on the same spot as those with the Society's needles, viz. an open space in the Botanic Garden at Liverpool.

3. Description and Analysis of a Mineral from Faroe, not before examined. By Arthur Connell, Esq.

The mineral in question was put into the author's hands by Mr Rose, mineral-dealer of this city, as a substance supposed to be a variety of mesotype. Mr Rose obtained it from Count Vargas Bedemar of Copenhagen, who had brought it from Faroe.

It has a pure white colour, with some opalescence and translucence, a glistening vitreous lustre, and somewhat greater hardness than fluor. Its texture is imperfectly fibrous; but the fibres in some places diverge with considerable regularity, shewing an approach to a crystalline structure. The specific gravity is 2.362; it is remarkably tough and difficultly frangible, so as to require much time and labour to separate a mass of it into smaller fragments.

It gives off water at a red heat; and is fusible *per se* before the blow-pipe only on the edges, without any swelling up. With soda it fuses with effervescence into a semi-transparent glass; with borax and salt of phosphorus, gives colourless glasses; and, with nitrate of cobalt, presents no alumina reaction. It gelatinizes readily with muriatic acid when reduced to powder. The analysis was effected by this reagent. After separating silica, the metallic oxides were thrown down by ammonia, and the lime by carbonate of ammonia. The al-